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MARCH 18, 1940

VOLUME 29 NUMBER 6

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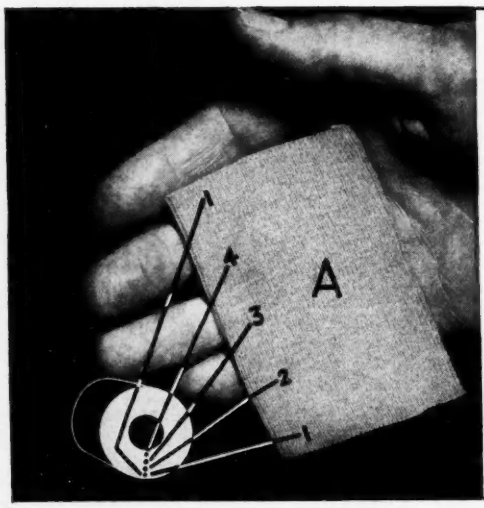
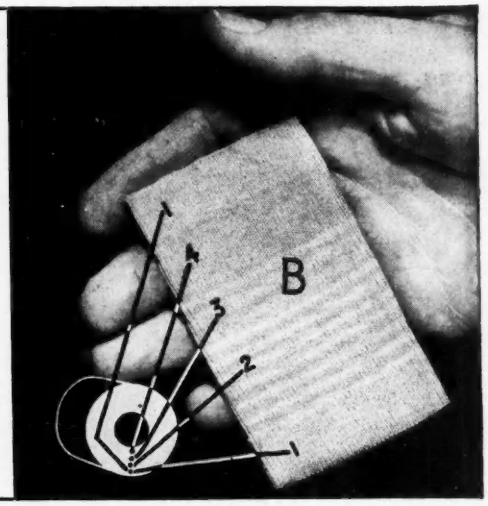


Note the level shade throughout test sock A. The yarn was dyed by the Calcoloid Pigment Method. Test sock B was knit from yarn vat dyed in the usual way. Both socks were knit with yarn from 4 locations in the package in rotation, with yarn from location 1 knit next to that from location 4 as a final check.



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DYESTUFF REPORTER

VOLUME 29 MARCH 18, 1940 NUMBER 6

Combination of Wool Protein with Acid and Base:

*Hydrochloric Acid and Potassium Hydroxide**

JACINTO STEINHARDT and MILTON HARRIS**

(Concluded from March 4, 1940 Issue)

PART II

IV. THEORY OF THE COMBINATION WITH ACID*

1. The Combination of Insoluble Ampholytes with the Anions of Acids

It has been shown in a previous section (III-1) that the acid bound by wool is a function of the concentration of salt as well as of the concentration of hydrogen ions. Furthermore, the way in which the total anion concentration (from acid plus salt) participates in any equation defining the amounts of acid bound under various conditions must be in some measure analogous to the manner of participation of the hydrogen ion. When it is considered that practically equivalent quantities of hydrogen and chloride ions must be combined, dissolved, or adsorbed by the fiber, it is evident that the extent to which one of these ions may be taken up depends in part on the simultaneous availability of ions of the opposite sign.

Restrictions of the latter kind in two-phase acid-base equilibria have long been known. Cases involving two sharply delimited phases, separated by a membrane which is impermeable to one or more of the ions present have been treated thermodynamically by Donnan[12, 13]. Application of the Donnan equations to the present case would involve elements of arbitrariness in the choice of volumes, concentrations, concentration-scale (because of the high concentration of dissolved substances), the distinction between acid bound by protein and acid merely dissolved by the medium present in the fiber phase, and in the allocation of the phase-boundary. It will be shown later that with such an arbitrary choice permitted, a good approximation to certain features of the data already described could be made. In other respects the approximation is less successful, and leads to consequences which appear to be incompatible with the comparison made above between data for wool and for soluble proteins. For these reasons, and because of the nearly complete interchangeability of hydrogen and chloride ions suggested by our results in acid solutions, it has seemed preferable to treat the restriction on the combination of wool with hydrogen ions more simply on the basis of three easily stated assumptions:

(1) *The fiber protein combines with chloride ions as well as with hydrogen ions, and the combination of both is subject to the law of mass action, or to the Langmuir adsorption law*†. This assumption may be thought of as implying the formation of a partially dissociated linkage between RNH_3^+ groups and Cl^- ions. Alternatively, the postively charged acid fiber might be thought of as forming a unimolecular adsorption layer of chloride ions. However, the observation that acid-dye anions permeate a wool fiber with a high degree of uniformity when time for full penetration is allowed shows that if the latter view be taken, adsorption does not occur merely on the outside of the fiber. The existence of stoichiometrical relations in the combination of acid and base by the wool also shows that the adsorption must occur on every molecule in the fiber.

(2) *No recognition need be taken of differences in hydrogen-ion concentrations inside and outside the fiber.* This may signify either that these concentrations are identical, or that they are related to one another in a way which is practically independent of the presence of other ions. The assumption appears to be incompatible with the conventional application of the Donnan treatment to two-phase systems. Nevertheless it represents a reasonable approximation, if postulate 1 given above is accepted; the existence of partially undissociated protein-chloride combinations would greatly minimize the differences predicted by the Donnan equations for the case of the combination of hydrogen ions alone. Since pH differences

*The acid branch of the titration curve has been chosen for discussion because it is composed of fewer distinct components. The treatment here proposed should be applicable, with suitable modifications, to the alkali branch as well.

†The assumption that the mass-action law may be applied implies that the fiber is a dispersed phase. In this case, the fiber must be thought of as a solid solution or as a solution of protein in imbibed water. If, on the other hand, the process of combination is one of adsorption, use of the Langmuir equation to describe it implies chemisorption at definite unsaturated points throughout the fiber; these points may be identified with the acidic and basic groups. Neither alternative involves new assumptions; the validity of one or the other is implied by the familiar experimental fact that the curves of acid combination by wool immersed in water are continuous and free of singular points. Derivations based either on the law of mass action or on the Langmuir adsorption equations necessarily lead to the same result.

The present treatment makes no assumption that the dispersed wool protein is a single chemical individual.

are the essential feature of the usual application of the Donnan equilibrium to fiber problems, disregard of this necessarily complicated and, in the present case, arbitrary treatment requires no further *a priori* justification.

Alternatively, postulate 1 may be regarded as a purely empirical way of evading explicit treatment of pH differences brought about by combination of the fiber protein with hydrogen ions alone. As will be shown later, both methods of calculation lead to very similar descriptions of a large part of the experimental phenomena, and a final choice between them can only be made on the basis of a wider field of observation, including comparisons with similar results with soluble proteins and with other insoluble materials, and the effects of other experimental variables which are still under investigation. In the meantime, the present treatment possesses a great advantage in simplicity of calculation.

(3) *The variation of activity-coefficients in the fiber phase may be disregarded.* This is the only procedure possible when the system is not accessible to direct measurement by independent means. The postulate is required only if the law of mass action rather than the Langmuir adsorption equation is used.

It is implied in postulate 1 that an equilibrium,

$$WCl^{\pm} \rightleftarrows W^{+} + Cl^{-}, \qquad (1)$$

in which $W^{\pm}$ represents wool in the uncombined state, occurs in addition to the more familiar acid-base equilibrium which may be written

$$WHCl \rightleftarrows WCl^{-} + H^{+} \qquad (2)$$

If these are the only two equilibria which can occur and if, for simplicity, wool is regarded as a divalent ampholyte, i.e., capable of combining a single equivalent of acid or a single equivalent of base, and two thermodynamic dissociation constants K_A' and K_H' are assigned to the equilibria (1) and (2) listed above, the law of mass action (plus postulate 3) or the Langmuir adsorption permits us to write:

$$\frac{[WHCl]}{[WHCl] + [WCl^{-}] + [W^{\pm}]} = \frac{1}{1 + \frac{K_H'}{a_H}\left(1 + \frac{K_A'}{a_{Cl}}\right)} \qquad (3)$$

The bracketed quantities represent concentrations, a_H and a_{Cl} the activities of hydrogen and chloride ions respectively, and the left hand member represents the fraction of the total wool combined with acid.

The resemblance of eq. 3 to the familiar expression for the ionization of a dibasic acid is apparent. If account is also taken of the hydrogen ions removed from the external solution by absorption in the fiber in an amount equivalent to the negative charge contributed by combined chloride ions, the ratio of acid taken up to total wool becomes:

$$\frac{[WHCl] + [WCl^{-}]}{[WHCl] + [WCl^{-}] + [W^{\pm}]} = \frac{1}{1 + \frac{K_H'K_A'}{a_{Cl}(a_H + K_H')}} \qquad (3')$$

Obviously the successive stages of combination might be formulated with equal *a priori* validity in the alternative equilibria:

$$WH^{+} \rightleftarrows W^{\pm} + H^{+} \qquad (4)$$

$$WHCl \rightleftarrows WH^{+} + Cl^{-} \qquad (5)$$

to which the dissociation constants K_H and K_A may be successively assigned. The corresponding form of eq. 3 is then

$$\frac{[WHCl]}{[WHCl] + [WH^{+}] + [W^{\pm}]} = \frac{1}{1 + \frac{K_A}{a_{Cl}}\left(1 + \frac{K_H}{a_H}\right)} \qquad (6)$$

and the corresponding form of eq. 3′ which represents more closely the measured quantities, is

$$\frac{[WHCl] + [WH^{+}]}{[WHCl] + [WH^{+}] + [W^{\pm}]} = \frac{1}{1 + \frac{K_HK_A}{a_H(a_{Cl} + K_A)}} \qquad (6)$$

The four dissociation constants which appear in these equations are obviously interrelated as follows:

$$K_AK_H = K_A'K_H'$$

Equations 3′ and 6′ differ from one another by the omission of different single terms in a complete expression for the sum of all the ionic states of the wool. This omission leads them to describe quite different relations between the hydrogen-ion and chloride-ion concentrations at which equal amounts of acid are taken up. Since there is no compelling reason for choosing between them, it is necessary to take both sets of equilibria into account in deriving the most general expression for the fraction of the maximum amount of acid bound as a function of a_H and a_{Cl}. This may be done in two ways, according to whether $[WH^{+}]$ is larger or smaller than $[WCl^{-}]$, since only the larger one of these two terms must be included in the numerator of the left-hand fraction, which expresses the part of the wool which binds acid. When $[WH^{+}]$ is the larger, the positive charge on the fiber is partly neutralized by the smaller term $[WCl^{-}]$ and partly by chloride ions in an adsorption layer.* Within the range of pH, and salt concentrations to which attention is here confined, and with any assignment of physically reasonable values to K_H' and K_A', $[WH^{+}]$ will be larger than $[WCl^{-}]$ and should therefore be chosen for inclusion in the numerator. This choice, implying $K_H \ll K_A'$, leads to the relation:

$$\frac{[WHCl] + [WH^{+}]}{[WHCl] + [WH^{+}] + [WCl^{-}] + [W^{\pm}]} = \frac{1}{1 + \frac{K_H'}{a_H}\left(\frac{a_{Cl} + K_A'}{a_{Cl} + K_A}\right)} \qquad (7)$$

*With dye anions of high affinity for wool fibers, such as those used in substantive dyeing, it would be necessary to substitute in the numerator a term analogous to $[WCl^{-}]$ in place of $[WH^{+}]$. When more than one kind of cation is present, however, (in the presence of salt), this simple substitution does not suffice. The considerably modified relations which are applicable to cases in which $K_A' < K_H$ are beyond the scope of the present paper.

The right-hand member of eq. 7, like that of eq. 3, which it closely resembles, differs from the expression for the dissociation residue of a monobasic acid only by the presence of the term in parenthesis. In the presence of a constant concentration of chloride ions this term is constant. Under these conditions the amount of undissociated acid varies with pH exactly as in the case of a monobasic acid, but the apparent strength of the acid (the position of the curve on the pH axis) varies with the magnitude of the bracketed term, which in turn depends on the concentration of chloride ions. With high anion concentrations the term in parenthesis approaches a limiting value of unity, and the dependence of the acid bound at any given pH on further increases in the anion concentration disappears. Thus, the limiting position of the titration curve is determined solely by K_H' and should correspond with the position of the titration curve of a similar *dissolved acid*. It has already been shown that these properties of eq. 7 correspond to experimental facts*.

The quantitative dependence of the positions of the titration curves described by eq. 7 on the level at which the anion concentration is held constant may be demonstrated by determining the pH for half-maximal combination as a function of the anion concentration. This may be done by equating the right-hand member of eq. 7 to 0.5. The resulting relation is:

$$\mathrm{pH}\ \frac{1}{2} = \mathrm{p}K_H' + \log\left(\frac{a_{Cl} + K_A}{a_{Cl} + K_A'}\right) \qquad (8)$$

In addition to the relation $K_H \ll K_A'$ already discussed, electrostatic considerations obviously require that $K_A' > K_A$ (and $K_H > K_H'$). Thus, in the range $K_A' \gg a_{Cl} \gg K_A$, the logarithmic term approaches $\log \frac{a_{Cl}}{K_A'}$, and the pH for half-maximal combination, which characterizes the position of the entire acid-combination curve, shows a close approximation to direct dependence on the logarithm of the concentration of chloride ions. This range of direct dependence extends down to the lowest possible values of a_{Cl} (equal concentrations of hydrogen and chloride ions). The upper limit of this range is determined by K_A' which determines the concentration of anions at which a limiting position of the curve is approached.

The properties of eq. 7 are illustrated in Figure 6 which shows the theoretical curves of acid-combination with respect to pH at several different values of $\frac{K_A'}{a_{Cl}}$. For purposes of calculation K_A has been taken as vanishingly small, since $K_A' \gg K_A$. It is noteworthy that the assignment of an infinitely small value to K_A would make the right-hand members of eq. 7 and 3 identical.

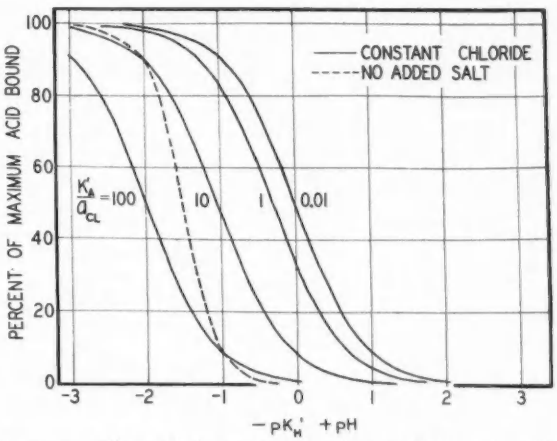

Figure 6. Theoretical curves of acid-combination described by equations 7 and 7'. The effect of variations in ionic strength is demonstrated by representation of curves for four different values of $\frac{K_A'}{a_{Cl}}$.

It is clear that the positions of the curves are determined by $\frac{K_A'}{a_{Cl}}$, although their shapes are independent of this ratio. The dependence of the positions on long $\frac{K_A'}{a_{Cl}}$ is at first linear, but becomes less marked as the ratio diminishes; finally, at very low values of the fraction (a_{Cl} large), the positions of curves approach a limit, determined by K_H'. By utilizing eq. 8, K_A' may be roughly evaluated from the pH differences at the midpoints of curves at two or more different salt concentrations sufficiently high to be beyond the region of simple stoichiometric dependence.

In solutions containing no added salt, a_{Cl} is not constant but equal to a_H. Equation 7 then becomes

$$\frac{[\mathrm{WHCl}] + [\mathrm{WH^+}]}{[\mathrm{WHCl}] + [\mathrm{WH^+}] + [\mathrm{WCl^-}] + [\mathrm{W^\pm}]} = \frac{1}{1 + \frac{K_H'}{a_H}\left(\frac{a_H + K_A'}{a_H + K_A}\right)} \qquad (7')$$

Since K_A' has already been assumed to be large, and K_A very small, there is a wide range of values of a_H in which the bracketed expression reduces to $\frac{K_A'}{a_H}$. The curve in the absence of salt is then described, up to moderately high acidities and high degree of combination, by the relation

$$\text{Fraction of maximum acid bound} = \frac{1}{1 + \frac{K_H' K_A'}{a_H^2}} \qquad (7'')$$

which is entirely consistent with the approximate description mentioned earlier: that the curve for the case of

*Thus, it is K_H' rather than K_H which corresponds to the dissociation constant of the acid in solution. This seems to imply that (in dilute solutions) K_H' is as little dependent on the nature of the anion as K_H. If this is true, the absolute values of K_A and K_A' can depend on the nature of the anion, but the ratio $\frac{K_A}{K_A'}$ cannot. The conclusion is a reasonable one if the difference between K_A and K_A' or K_H and K_H' is attributed almost entirely to an electrostatic effect due to a single charge.

no added salt could be related to the curves at constant ionic strength by substitutions of $[H^+]^2$ for $[H^+]$ in functions describing the latter. The curve in Figure 6 labelled *no added salt* is drawn to represent eq. 7'. K_A' has been taken to be 1000 K_H' (approximately 0.1) and K_A is considered negligibly small. In contrast with the curves for constant ionic strengths, the value of K_A' affects not only the pH value at which a given amount of acid is bound, but also the exact form of the relation between acid bound and pH. If K_A' is taken sufficiently small, the no-salt curve loses its characteristic steepness and becomes identical with the curves for constant ionic strength. Thus two additional means of estimating K_A' become available: (1) the difference in pH between the midpoint of the no-salt curve and any one curve at constant ionic strength; and (2), the extent to which the no-salt curves differ in slope from the curves at constant ionic strength. The value of K_A' selected for graphical representation in the no-added-salt curve of Figure 6 (approximately 0.1) was chosen because it gives very nearly the proper separation from the other curves when the same value is substituted into the value of $\frac{K_A}{a_{Cl}}$ attached to each of them.

The most exacting of the remaining tests which could be applied to the consequences developed from the postulates would be to attempt superposition of the several sets of data with the theoretical curves described by eq. 7 or 7'. These equations, however, were derived for the simplest case of monovalent acids; and wool, like other proteins, is highly polyvalent. This difference can have either of two results: (1) if all the dissociating groups have identical *intrinsic* dissociation constants and if they are far enough removed from one another in the molecule to exclude appreciable electrical interaction between them, the acid-combining curves, as Sinns[40], Weber[51], von Muralt[49], and others have shown, should be identical with those of a monobasic acid, and eq. 7 and 7' should be applicable. (2) if the groups are of unequal intrinsic strength, or if they are of equal intrinsic strength but are close enough to one another so that changes in distribution of electric charges, caused by partial dissociation, weaken the dissociating tendency of the remaining groups, the resulting acid-combination curve would be the sum of a number of smaller curves distributed along the pH axis. Consequently it would be broader with respect to the pH axis than those predicted by the equations above.

In the direct comparison presented in Figure 7, the estimated contribution of the imidazole groups (.03 millimole) has been subtracted from the acid-combination data in an effort to have them represent as nearly as possible only the dissociation of carboxyl groups*. As the

*The subtraction of a constant quantity is justified only at pH values more acid than those at which imidazole groups begin to give off hydrogen ions. In 0.2 *M* salt solutions, the correction should diminish appreciably at pH 5.4 and become zero at pH 6.4. Since the pH at which the correction should diminish in solutions low in salt or containing no salt cannot be estimated, recourse has been had to the subtraction of a quantity independent of pH. This results in varying degrees of over-correction at the low end of each set of data, but the effect is small.

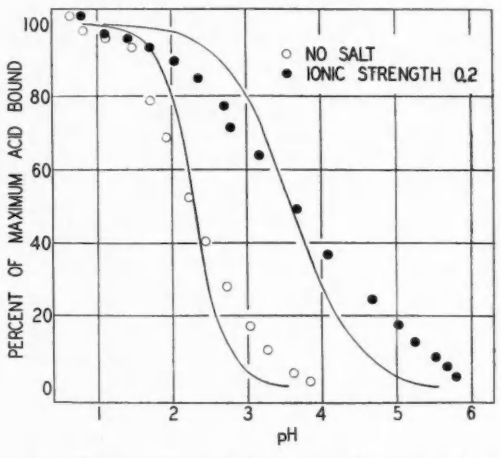

Figure 7. The experimental data for acid combination as a function of pH compared with theoretical curves for a monobasic acid (equations 7 and 7'). An estimated contribution from the histidine content of .03 millimole per gram has been subtracted from the experimental values, as described in the text.

figure makes clear, the corrected experimental curves, both in the presence and absence of salt are broader than the theoretical ones, and the second of the two alternatives stated above must prevail.

The high degree of symmetry of the differences between the experimental and the theoretical curves suggests, however, that the experimental curve is not the sum of a small number of distinct groups of curves characterized by *widely different* dissociation constants, but is the result of a very regular kind of electrostatic interaction between ionic charges affecting the dissociation of groups which are all intrinsically similar. Earlier analyses of the acid-titration curves of other proteins[5, 8, 9, 10, 17] have been based on the opposite assumption of distinct groups characterized by widely different constants.

The view suggested above is based on considerations similar to those which led Cannan to the same conclusion for the titration curve of egg albumen; it receives added support from the fact that the midpoint of the experimental curve (at high salt concentrations) occurs at a pH (4.0-4.1) which may be expected to characterize the dissociation of carboxyl groups in large peptides[6], and by other considerations discussed below.

The regularity of the difference between the theoretical curve for a monovalent acid and the experimental curve is shown more clearly if the ordinates of all the curves, after subtraction of the estimated contribution of histidine, are changed from the acid bound to $\log \frac{A}{A_m - A}$ where A signifies the amount of acid bound at any pH and A_m is the maximum acid-binding capacity. The resulting graphs of the measurements at constant ionic strength, shown in Figure 8, are close approximations to straight lines which are roughly parallel over a wide part of their total range.

(Continued on page 147)

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March 18, 1940

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Members should notify the **Secretary** immediately of all address changes

• CALENDAR • OF COMING EVENTS

Lecture, Sponsored by Mid-West Section, Lecture Hall, Chicago Lighting Institute, 202 North Wacker Drive, Chicago, Ill., 8 P.M., March 22, 1940. Speaker: Dr. Malcolm Dole, Northwestern University, "Physical Chemistry of the Newer Detergent Processes."

Meeting, New York Section, Chemists' Club, 52 East 41st St., New York, N. Y., March 29, 1940. Speakers: Paul J. Choquette, Cranston Print Works, "Control in the Processing of Spun Rayon Piece Goods"; Barrett Fisher, Sydney Blumenthal Co., "The Dyeing and Finishing of Pile Fabrics."

Meeting, Rhode Island Section, Providence Engineering Society, 195 Angell Street, Providence, R. I., March 29, 1940. Speakers: Dr. Carl Z. Draves, General Dyestuff Corp., "The Kier Boiling of Linen"; Philip H. Stott, E. I. duPont de Nemours & Co., Inc., "The Dyeing of Nylon."

Meetings, Council and Research Committee, National Bureau of Standards, Washington, D. C., April 19, 1940.

Meeting, Philadelphia Section, Penn A. C., 18th and Locust Sts., Philadelphia, Pa., April 26, 1940.

Spring Meeting, Piedmont Section, King Cotton Hotel, Greensboro, N. C., April 27, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

The Source of Metals in Dyed Cottons to be Rubberized*

CHARLES A. SEIBERT**

THE potency of relatively minute quantities of metals to accelerate oxidation and thus destruction of rubber, is well known.

While many metals exhibit catalytic tendency in this respect, our interest is principally with those most usually found in textiles. These are iron, copper and manganese, and of these copper is the chief offender, because while less potent than manganese, it is much more often found present in objectionable quantity. Traces, at least, of iron will usually be found in the majority of cotton fabrics and yarns. However, it is less destructively potent than copper and the quantity present is usually much less than is objectionable.

As of probable general interest to the subject, may I state that the rubber chemists tell us that the type of destruction of rubber with which we are interested is the result of oxidation, and that heat and light are potent natural activation agencies.

Normally, the destruction passes through two distinct stages; first, a softening of the rubber and then hardening with brittleness.

There are, as we know, means available to retard the rate at which oxidation proceeds. These are of two forms: the antioxidants which retard normal and natural oxidation and deterioration, and the inhibitors which counteract or inhibit the normal tendency of metals to accelerate oxidation. Whether the use of the latter, the existence of which is perhaps not generally known to the textile industry, can be considered as a panacea for the ills caused by the metals, I cannot state as a result of my personal experience. However, the rubber chemists are hopeful that they will prove a valuable step in that direction.

It may also be of interest to quote the rubber chemist to the effect that the metals are principally potent catalysts when they are in readily ionizable form.

Among the many possible sources of contamination is direct contact of the fabric with metal, such as passage over spreader bars and dry cans. This source has been greatly reduced by the elimination of the offenders.

It is by no means unusual to find cotton containing a greater than permissible quantity of copper, the source of which is traced to the presence of copper or brass fittings in apparatus used for its wet processing. The proof of that as the source of contamination lies in the fact that the removal of the suspected fittings results in processed materials free of the metal in objectionable quantity.

As a matter of record, may I mention that the quantities of the three most usually found metals permissible in fabrics to be rubberized are, in accordance with the Rubber Proofers Association specifications: iron .1, copper .001 and manganese .0005 per cent. These are rather small quantities and cause speculation regarding whether there may not exist unsuspected sources of contamination, several of which, each contributing a negligible quantity alone, will together make the total more than the permissible. This speculation is prompted as a necessity to assign a possible cause for some unusual losses in elasticity, for which no other logical reason can be assigned, even when processing procedure, apparatus, conditions of use, and storage, as well as the material fundamentally, are definitely known to be beyond suspicion, or as nearly so as is humanly possible to establish.

In our efforts to determine sources of contamination, everything is under suspicion until it is proven innocent.

Dyes, chemicals and other assistants used in wet processing are not chemically pure substances. Some dyes contain copper in their chemical constitution, but these, however, are rarely used for materials that are to be rubberized. Some few exhibit such valuable properties that they are used in small quantities despite the fact that they contain copper. Many dyes contain very small quantities of copper in the form of impurities. This is generally known and when difficulties arise, it is only natural that the dyes are suspected as a possible cause. In an effort to learn how much, if any, copper a dye could obtain and still be safely useful for materials to be rubberized, experiments were undertaken, the results of which are described in the following reports.

EXPERIMENT A

Can the Copper Absorbed by Cotton During Dyeing be Accurately Predicted, if the Quantity in the Dye is Known?

In an effort to determine if the quantity of copper absorbed by cotton during dyeing could be correlated with the quantity the dye contained, three lots of dyes were analyzed for their content.

*Presented at meeting, Rhode Island Section, January 26, 1940.
**E. I. du Pont de Nemours & Co., Inc.

Dye	*Lot number*	*Copper content of the dye*	*Percentage of dye used*	*Copper content of the dyed cotton*	*What it should be if all in the dye was taken up by the cotton*
"Pontamine"					
Brown BT Conc.	44	0.0130%	1%	0.0008	*0.00033%
			5	0.0009	0.00085
			10	0.0007	0.0015
Brown BT Conc.	45	0.0130	1	0.0006	0.00033
			5	0.0006	0.00085
			10	0.0005	0.0015
Sky Blue 6BX	121	0.0084	1	0.0004	0.000284
			5	0.0004	0.000620
			10	0.0007	0.00104
Control-undyed cotton	...	.....	..	0.0002	.....

*Calculated on the basis of the dye content in addition to the quantity found in the undyed controls.

From a 40 to 50 yard roll of bleached muslin used for printing, a piece weighing 400 grams was cut. This was divided into twelve 20 gram pieces. Three of these, selected from different sections, were preserved for copper content determinations. The remaining nine were dyed in a 20/1 liquor volume ratio with 1-5 and 10 per cent quantities of the three dyes, using as the exhausting assistant, common salt known by analysis to contain a negligible quantity of copper, usually reported as (nil.)

After dyeing, the dyed pieces and controls were analyzed. The pertinent information in tabular form appears at the top of this page.

Conclusions: A logical conclusion that may be drawn from these data is that the present methods of analysis do not provide accurate figures when the quantity present is below the third decimal place, and/or that the quantity of copper that the cotton will absorb from the dyebath cannot be accurately anticipated on the basis of the quantity that the dye contains.

EXPERIMENT B

In experiment A, dyes of a known relatively low copper content were used. In this, experiment B, one dye of abnormally high content is included, and the pertinent information in tabular form appears at the bottom of this page.

Conclusions: Similar to those drawn from experiment A with the addition of illustrating the influence of the presence of chrome on the accuracy of the analytical data.

Dye	*Lot*	*Copper content*	*Percentage of dye used*	*Copper content of the dyed cotton*		*What it should be if all in the dye was taken up by the cotton*
"Sulfogene"						
Bordeaux BRN	70	0.58%	1%	*0.0057%	0.0052	**0.0058%
			5	0.013	0.009	0.029
			10	0.013	0.02	0.058
			20	0.016	0.03	0.116
Bordeaux 5CF	75	0.0042	1	0.0008	0.0019	0.000042
			5	0.0011	0.0016	0.00021
			10	0.0004	0.0015	0.00042
			20	0.0005	0.002	0.00084
Sodium sulfide		nil				
Sodium carbonate CP						
Sodium chloride		nil				
Sodium di-chromate CP						
Acetic acid Glacial						
Sodium perborate Technical						
Control-undyed cotton		nil				

*These are the figures from a set of dyeings oxidized with the usual 0.25 oz./gal. sodium dichromate and 0.5 oz./gal. (56 per cent) acetic acid at 140 F., whereas the next following figures are those of portions of identical dyeings oxidized by treatment in a 0.25 oz./gal. solution of sodium perborate.

These duplicate sets were made to illustrate that the presence of chrome, which it is difficult to remove entirely in the usual rinsing operation, makes accurate colorimetric determinations difficult, if not impossible.

**Calculated on the basis of the dye content only, assuming the cotton to contain none as indicated by the figure for the undyed controls.

EXPERIMENT C

It is well known that cotton will take up copper in contact with the metal as when dried on copper cans, and also in wet processing when the equipment contains copper in the form of fittings.

One processor suspected as the source of contamination the possibility of the starch size, because it was prepared in a jacketed copper kettle.

Experiments to provide information produced the following:

The cotton cloth used for the experiments was an unbleached muslin, thoroughly desized and scoured.

Liquor volume ratios 30/1 and material dried without previous rinsing.

		Copper content
	Cotton muslin used for the experiments....	nil
1	Treated in distilled water at the boil for 5 minutes in a stainless steel beaker and dried in the air.....	trace
2	A portion of No. 1, dried on a copper can.	0.0006%
3	Treated in distilled water at the boil for 5 minutes in a copper beaker and dried in the air	0.0005
4	A portion of No. 3, dried on a copper can.	0.0006
5	Treated in a copper beaker for 5 minutes at a boil in distilled water containing 10 gr./liter starch and then dried in the air.....	0.0007
6	A portion of No. 5, dried on a copper can.	0.0007
7	Treated in a copper beaker for 5 minutes at a boil in distilled water containing 10 gr./liter starch and ½ gr./liter tallow and than dried in the air.....	trace
8	A portion of No. 7, dried on a copper can.	0.0007

Conclusions: Both copper drying cans and metal fittings are potent sources of contamination, however, in these experiments not in a quantity sufficient to be objectionable.

EXPERIMENT D

This is a comparative set of dyeings made on packages in circulating liquor machines, using for each set, identical cotton, dyes, assistants and quantities, with procedure as nearly identical as it is possible to make it.

The essential difference between the dyeings is:

Designated SET A in the tabulation.

Made in a 1 pound, one package, stainless steel machine, using a package wound on stainless steel.

Before use this machine was taken apart and carefully examined to be certain that it did not contain any brass or copper in the form of fittings.

Designated SET B in the tabulation.

This set was made on a practical scale in a cast iron circulating liquor machine, using packages wound on stainless steel. However, the packages were placed over monel metal spindles in the machine, whereas in SET A the spindle was of stainless steel.

The metal content of the dyes and assistants used was:

	Copper	*Manganese*
Primuline Conc.	.0026%	nil
Diazo Orange G	.0015	nil
Diazo Violet NT	.002	nil
Sulfur Bordeaux PCF	*.010	*.118
Sulfur Brown RBNCF	.003	.0002
Sulfur Black HCF	.00073	nil
Sulfur Black RCCF	.0004	.0003
Sodium sulfide	.00004	nil
Brine-sodium chloride solution...	.00003	nil
Water	nil	nil
Sodium chloride dry—used for the developed color dyeings	.0005	trace
Sodium nitrite	nil	nil
Sulfuric acid	.0002	nil
Soda ash	nil	nil

* These figures were checked by duplicate analysis.

The materials for Experiment D and the large scale dyeings and liquor samples were obtained through the courtesy of the management of Cannon Mills No. 6, Concord, N. C. Thanks are also expressed to Mr. E. P. Davidson, Assistant Manager Technical of the Charlotte, N. C. Branch of the Dyestuffs Division of the DuPont Company, for his valuable assistance in providing the samples for the A portion series of the experiment.

Developed Color Wine Shade

Dye	*Quantity in per cent*	**Copper*	**Manganese*
Primuline Conc.	10.00	.0026	nil
Diazo Violet NT	0.94	.002	nil
Diazo Orange G	0.57	.0015	nil

** In all instances these are the quantities found in the dyes and has no relation to the quantity that may have been anticipated because of the quantity used for the dyeings.

	SET A		*SET B*	
LIQUORS	*Cu.*	*Mn.*	*Cu.*	*Mn.*
Dye bath—at start ..	.00021%	nil	.0002	nil%
Dye bath—after use ..	.00018	nil	.0003	nil
Diazo bath—at start..	.00010	nil	nil	nil
Diazo bath—after use.	.00054	.0001	.0014	.00009
Developer bath—at start	.00010	nil	nil	nil
Developer bath—after use	.00010	nil	nil	nil
COTTON YARN				
Before dyeing	nil	nil	.0008	.0003
After dyeing	.00049	nil	.0008	.0001
After diazotizing	.00052	nil	.042	nil
After development ..				
Outside of package...	.0014	nil	.013	nil
Center of package....	.0003	nil	.0057	nil
Inside of package....	.00067	nil	.0050	nil
Spring sleeve	.0028	nil	.015	nil

Sulfur Brown Shade

Dye	Quantity in per cent	Copper	Manganese
Sulfur Brown RBNCF	13.00	.003	.0002%
Sulfur Bordeaux PCF	2.5	.010	.118
Sodium sulfide	16.00	.00004	nil
Salt brine	30.00	.00003	nil
Caustic soda	1.0		

LIQUORS	SET A Cu.	SET A Mn.	SET B Cu.	SET B Mn.
Dye bath—at start.	.00014	nil	.00005	.00003
Dye bath—after use	.00012	nil	nil	nil
COTTON YARN				
Before dyeing	nil	nil	.0003	.0005
After dyeing				
Outside of package.	.0015	.0007	.0014	.0019
Center of package.	.0013	.0009	.0011	.0016
Inside of package.	.0014	.0006	.00097	.0018
Spring sleeve	.0016	.0004	.003	.001

Sulfur Grey Shade

Sulfur Black HCF	0.22	.00073	nil
Sulfur Bordeaux PCF.	0.044	.010	.118
Sodium sulfide	1.0	.00004	nil
Salt brine	20.0	.00003	nil
Caustic soda	1.0		

LIQUORS	SET A Cu.	SET A Mn.	SET B Cu.	SET B Mn.
Dye bath—at start.	.00004	nil	.00012	nil
Dye bath—after use	nil	nil	.0001	nil
COTTON YARN				
Before dyeing	nil	nil	.0007	.0003
After dyeing				
Outside of package.	.0015	.0007	.0010	.0005
Center of package.	.0008	nil	.0006	.0003
Inside of package.	.0006	.0003	.0008	.0004
Spring sleeve	.0021	nil	.005	nil

Sulfur Black Shade

Sulfur Black RCCF.	30.0	.0004	.0003
Salt Brine	30.0	.00003	nil
Caustic soda	5.0		

LIQUORS	SET A Cu.	SET A Mn.	SET B Cu.	SET B Mn.
Dye bath—at start.	.0001	nil	.00018	nil
Dye bath—after use.	.00006	nil	.00022	nil
COTTON YARN				
Before dyeing	.00028	nil.	.0006	.0004
After dyeing				
Outside of package.	nil	nil	.0012	nil
Center of package.	nil	nil	.0015	.0001
Inside of package.	nil	nil	.0013	.00004
Spring sleeve	.0014	nil	.013	nil

The information these data provide indicates:

In Relation to the Liquors—

The quantity of copper found in the dye baths before use is much less than is anticipated on the basis of the quantity found in the dyes and assistants.

If copper is present in the dye liquors, some of it is absorbed by the cotton; however, in these experiments that quantity is not consistent in relation to the total quantity present. In two of the SET A experiments it is approximately 14 per cent, in one 40 per cent and in the other, the entire quantity, 100 per cent. It is also observed that in the SET B liquors, two of the four contain more copper after use than before use.

In Relation to the Cotton—

The quantity of copper that the cotton contained after dyeing is in many instances much greater than the quantity the dyes and assistants contained, and also than the differences in the quantities the baths contained before and after use.

There are a few exceptions; however, the figures indicate that the copper extracted from the Monel metal is quickly transferred to the cotton. If it remained in the liquor for any appreciable length of time it is reasonable to assume that more of it would be found in the liquors after their use and it would be distributed more uniformly throughout the packages. This may indicate that it is in a finely dispersed form and not in solution.

That the Monel metal spindles are a source from which a large portion of the metal is obtained may be inferred from the fact that the sleeves that cover the springs contain the greatest quantity. These sleeves are knitted cotton with the spaces between the threads much too far apart to act as a filter to prevent circulation of the metal through them and they are much less effective filters for this purpose than the cotton on the packages which is much more closely wound.

It is interesting to speculate where the copper comes from that is found in the packages in the SET A dyeings, especially as the springs are of stainless steel and the machine contains no copper or brass.

In this summary more attention is directed to the copper than manganese content, because it is the former that is most often found in greater than permissible quantity.

DISCUSSION

Q.: Suppose you have 100,000 yards of goods dyed and it has too much copper in it to suit the rubber people, what would you do with it?

A.: That is the reason I have stressed the inhibitor. We do not know how to take it out without physical deterioration of the material.

Q.: According to the figures in the chart does it indicate you build up your copper content in the standing bath?

A.: We have not gone that far yet. This work was only completed a month ago and we still hope to add to it.

ONE HUNDRED AND TWENTY-SIXTH COUNCIL MEETING

THE Council held its 126th meeting at the Engineers' Club in Boston, on Friday morning, Jan. 26, 1940. Present were President Carl Z. Draves, presiding; William R. Moorhouse, Treasurer; Louis A. Olney, Chairman of the Research Committee; William H. Cady and P. J. Wood, Past Presidents; Kenneth H. Barnard and Walter M. Scott representing Northern New England; Fderedic A. Prisley representing Rhode Island; Henry F. Herrmann and Harold W. Stiegler representing New York; Charles A. Seibert and Herbert S. Travis representing Philadelphia; Perrin N. Collier representing the Southeastern Section; and Harold C. Chapin, Secretary. The Secretary's report of the 125th Council meeting and balance sheet of Jan. 20, the Treasurer's report of Jan. 25, and the Auditor's report for the last complete fiscal year, were accepted. A report of Jan. 15 from the Treasurer of the South Central Section was approved. Continuation of Associate membership in the American Standards Association was voted, but membership in the National Farm Chemurgic Council was discontinued.

Mr. Seibert presented the report of the committee appointed at the 125th Council meeting to draft amendments to the By-Laws which would permit the fiscal year of the Association to begin August first, without changing the dues year. This was approved, and the Secretary was instructed to submit the proposed amendments to letter ballot of the Council.

The Committee on Coordination and Publicity was thanked for its recommendations, and in accordance with its request discharged. The President was authorized to appoint another Committee on Publicity, and Mr. Ryberg was instructed to supply this committee periodically with such material from his work as might be suitable for general publication. The booklet, provided for under part of the $6,800 appropriation of the Nov. 17 Council meeting, it was decided, should be principally a reprint of that section of the Year Book devoted to Standard Methods, together with a few pages of introductory matter on the purposes of the Association. Publication and free distribution of this booklet was assigned to the Year Book Committee. In his work of coordinating the research activities of the committees of this Association with each other and with other organizations, it was voted that Mr. Ryberg report directly to the Council at each meeting, but in those details of the work not specified by the Council, it was voted that he be subject to the direction of the Chairman of the Research Committee.

The dates October 18 and 19, selected by the New York Section for the next General Meeting, were approved; also the proposal that each Section be invited to present a paper of group authorship in competition for a prize to be awarded at the banquet. Further details were left to the Technical Program Committee, with authorization to spend any amount within the $100 permitted by the By-Laws for prizes, and with the understanding that awards be made by a committee consisting of the Chairman of the Research Committee as Chairman, and one representative from each Section.

It was voted that the next Council meeting be in Washington, at the National Bureau of Standards, on Friday morning, April 19.

Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided no objection be received meanwhile by the Secretary:

Senior

C. H. Bayley	M. W. Hardie	J. L. Nauman
J. S. Boyd	P. A. Hurlocker	A. T. Oleson
J. A. Branegan, Jr.	M. E. Johnson	E. M. Olson
B. S. Bronner	M. B. Kaesche	C. H. Patrick
W. B. Burnett	L. T. Kelly	L. E. Pratt
D. Carter	G. P. Kovacs	A. F. Rodenhaven
C. E. Coke	G. G. Liebig	E. P. Sommer
J. W. Creeley	F. R. Lopez	B. V. Sullivan
F. Eayrs	D. MacGregor	F. E. Starkie
E. E. Falberg	M. N. Manfra	W. M. Thornton
J. K. Gass, Jr.	E. Mayer	H. F. Topliff
W. P. Hall	R. W. McKay	E. A. Wolff
R. B. Hallowell	O. Morningstar	J. W. Zook
	A. J. Morse	

Junior

A. E. Bedrick	B. C. Gallagher	E. T. Lesure
H. L. Beidler	O. J. Goldstein	I. Pitchersky
H. Blackledge	C. M. Good	F. J. Potter
K. E. Brown	E. L. Grilli	S. Schlenker
A. DeChampagne	G. Hermann	B. C. Winkler
L. H. Elizer	E. R. Kaswell	L. J. Winn
H. M. Erwin	J. Kritchevsky	J. Zeitlin

Associate

W. Akam	E. L. Murphy, Jr.	L. M. Shafer
M. F. Costello	A. Nazzaro	M. K. Souders
D. Fisher	D. H. Palmer	E. P. Wenzelberger
M. W. Fletcher	C. C. Rapp	I. V. Wilson
R. P. Fondor	P. E. Reth	W. J. Wood
R. W. Mann	S. W. Rusk	E. A. Zillessen

Student

C. O. Carlin, Jr.	E. P. James	D. Rawlinson
J. E. Dunson	J. R. Leal	P. V. Riley
A. W. Goodwin	J. Leontire	E. V. Santos
A. T. Hamilton	G. J. Littlewood 3rd	R. J. Wiley
R. E. Hawes	E. V. Patenaude	E. V. Wilson
N. A. Inkpen		T. M. Ziemba

The following were transferred from other classifications to Senior: A. A. Caddell, R. J. Carey, Jr., G. M. Kidder, H. E. Knox, A. G. McNair, A. C. Merrill, S. Powell, Jr., A. Spadetti.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

SECRETARY'S BALANCE SHEET—JANUARY 20, 1940

	Applications	*Dues, Regular and Reinstate.*	*Dues, Corporate and Sustaining*	*Miscellaneous*	*Bank Charges*	*Totals*
Brought forward, and received by Secretary to Nov. 10, 1939	$132.50	$2,317.17	$1,905.00	$3.80	—$1.00	$4,357.47
Received by Secretary, Nov. 10, 1939, to Jan. 20, 1940	367.50	3,306.25	420.00	350.04*	— 1.42	4,442.37
Total received	500.00	5,623.42	2,325.00	353.84	— 2.42	8,799.84
Transmitted to Treasurer	500.00	5,505.92	2,325.00	353.84		8,684.76
Leaving to order of Secretary		117.50			— 2.42	115.08

MISCELLANEOUS ITEMS*

Knitted tubing	$156.48	Buttons	7.50
Dyestuff Reporters	1.20	Carbonizing reports	5.00
Crock cloth	3.70	Printing Paste reports	1.20
Dyed standards	20.25		
Year Books	154.71		$350.04

MEETING, NORTHERN NEW ENGLAND SECTION

A MEETING of the Northern New England Section was held at the Hotel Manger, Boston, Massachusetts, on Friday, February 2, 1940. There were eighty-six members present at the dinner and approximately one-hundred members attended the business meeting and technical program which followed.

Dr. Harold W. Stiegler, Head, Textile Division, American Cynamid Company, and a member of the New York Section, gave an interesting talk on "Chemists and Chemicals in the Textile Industry," emphasizing particularly a chemical explanation of the new synthetic resin finishes and cationic softening materials. This talk was supplemented by motion pictures showing the laboratory facilities, synthetic resin manufacturing, etc., of the American Cyanamid Company.

At the conclusion of this talk, a short question and answer period was conducted by Dr. Stiegler.

Respectfully submitted,

JOHN N. DALTON, *Secretary.*

MEETING, MID-WEST SECTION

A MEETING of the Mid-west Section was held at the Sherman Hotel, Chicago, Illinois, on Saturday, February 10, 1940. A discussional meeting was held at 3:00 P.M., conducted by Archie Alexander. Virgil Hartquist gave a talk on "Lights of the Newer Types for Color Matching." This was followed by a very interesting open discussion. There were 75 members and guests present.

Dinner was served at 7:00 P.M. in the College Inn. There were 91 members and guests.

The business meeting was called to order in the Crystal Room at 9:00 P.M. by Chairman Herman Boxser. The reports of the Treasurer and Secretary were read and approved. A. T. Brainerd, Chairman of the Nominating Committee, composed of, beside himself, Charles Lennox, Robert Griswald and Joseph Feit, announced that the following were selected.

Chairman, Herman Boxser; Vice-Chairman, A. G. Alexander; Treasurer, Frank Acker; Secretary, David Anderson; Representative to the National Council, Virgil Hartquist; Sectional Committee, H. H. Tucker, Elliot Morrill, James Morrison and James Morgan; Representative to the National Nominating Committee—E. J. Siegrist.

Mr. Brainerd made the motion that the Secretary cast one ballot. This was seconded and unanimously approved.

Mr. Boxser then introduced H. Millson of the Calco Company. Mr. Millson gave a talk on "Microscopic Observation of Wool Dyeing" with moving pictures and slides. This talk was very well received.

The meeting was adjourned at 11:00 P.M.

Respectfully submitted,

DAVID ANDERSON, *Secretary.*

Reports of Secretary and Treasurer

SECRETARY'S REPORT

On Sept. 11th our Association had 2,404 members and applicants for membership with dues paid. Compared with 2,275 on November 1st of last year, this indicates a probable gain of at least 6 per cent for the full fiscal year.

After two years of committee work the Association adopted this year a new Constitution and By-Laws. These were published in the AMERICAN DYESTUFF REPORTER before adoption, and will be published, as amended, in the coming Year Book.

Council meetings were held and reported as follows:

121st, New York, Feb. 11, 1939, Am. Dyestuff Reptr., *28*, P155, 1939.

122nd, Philadelphia, April 21, 1939, Am. Dyestuff Reptr., *28*, P265, 1939.

123rd, New York, June 16, 1939, Am. Dyestuff Reptr., *28*, P428, 1939.

124th, Boston, Sept. 15, 1939, Am. Dyestuff Reptr., *28*, P674, 1939.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary*.

TREASURER'S REPORT

Year Ending October 31, 1939

To the Members of the

American Association of Textile Chemists & Colorists:

We have made an examination of the accompanying statement summarizing the receipts and disbursements of the treasurer and secretary of the American Association of Textile Chemists & Colorists for the year ending October 31, 1939. In connection therewith, we examined or tested the cashbooks and other supporting records of receipts and disbursements of the treasurer and secretary and obtained information and explanations from the officials.

In our opinion, based upon such examination, the accompanying statement, together with the supporting schedule, fairly present a summary of the recorded receipts and disbursements of the association for the year ending October 31, 1939 and the balances of cash on hand and in banks as of the close of the period under review.

PRICE, WATERHOUSE & Co.

November 20, 1939.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS & COLORISTS

STATEMENT SUMMARIZING RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDING OCTOBER 31, 1939

		Allocation of funds			
	Total	*Research*	*Merchandise*	*General*	*Annual meeting*
Treasurer's Account					
Receipts:					
Secretary's receipts remitted to treasurer—					
Membership dues	$17,062.80	$2,825.00	$.....	$14,237.80	$.....
Miscellaneous income (per schedule attached)	2,386.95	231.75	1,073.20	.....	1,082.00
Together (see below)	$19,449.75	$3,056.75	$1,073.20	$14,237.80	$1,082.00
Research donation—Textile Foundation	2,500.00	2,500.00	.....	.....	.....
Interest on bank deposit	75.00	.....	.....	75.00	.....
Total receipts	$22,024.75	$5,556.75	$1,073.20	$14,312.80	$1,082.00
Disbursements:					
Research salaries, fees and expenses	$5,460.50	$5,460.50	$.....	$.....	$.....
Howes Publishing Co.—Subscriptions to American Dyestuff Reporter	5,765.00	75.00	.....	5,690.00	.....
Secretary's expenses, postage, etc.	1,815.05	.....	46.45	1,720.15	48.45
Printing, etc.	410.91	4.00	.....	206.89	200.02
Merchandise purchases	455.68	.....	455.68	.....	.....
Section membership allowances	1,003.15	.....	.....	1,003.15	.....
Trade association dues	125.00	.....	.....	125.00	.....
Audit of treasurer's and secretary's accounts	65.00	.....	.....	65.00	.....
Council and other expenses	423.11	.....	.....	95.90	327.21
Total disbursements	$15,523.40	$5,539.50	$ 502.13	$ 8,906.09	$ 575.68
Excess of receipts over disbursements	$ 6,501.35	$ 17.25	$ 571.07	$ 5,406.71	$ 506.32
Cash in bank at October 31, 1938	31,580.34	9,287.71	1,358.08	19,309.16	1,625.39
Cash in bank at October 31, 1939	$38,081.69	$9,304.96	$1,929.15	$24,715.87	$2,131.71
The First National Bank of Boston—Savings account	$ 5,000.00				
The First National Bank of Boston—Checking account	33,081.69				
	$38,081.69				

Secretary's Account

Receipts:	
Membership dues for the year ending October 31, 1939	$14,287.37
Membership dues for the year ending October 31, 1940	3,210.35
Miscellaneous Income	2,386.95
	$19,884.67
Disbursements:	
Remitted to treasurer—membership dues and miscellaneous income (see above)	$19,449.75
Bank charges	4.49
	$19,454.24
Excess of receipts over disbursements	$ 430.43
Cash in bank at October 31, 1938	20.24
Cash on hand and in bank at October 31, 1939	$ 450.67
Appleton National Bank, Lowell	$ 442.32
Undeposited receipts	8.35
	$ 450.67

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS & COLORISTS

SCHEDULE OF MISCELLANEOUS INCOME FOR THE YEAR ENDING OCTOBER 31, 1939

Miscellaneous Income:	
Research—	
Launder-Ometer royalties	$184.00
Carbonizing reports	8.50
Light fastness reports	25.50
Wool determination reports	.40
Insurance rebate	13.35
	$231.75
Merchandise—	
Year books	$699.66
Dye standards	56.98
Knitted tubing	113.42
Dyestuff Reporters	60.95
Crock-meter cloth	34.35
Crock meters	72.59
Analytical methods	3.25
Buttons	28.50
Wash fastness standards	3.50
	$1,073.20
Annual meeting—	
Registrations	1,082.00
Total miscellaneous income	$2,386.95

Respectfully submitted,

W. R. MOORHOUSE,
Treasurer,

American Association of Textile Chemists & Colorists.

REPORT OF THE SUB-COMMITTEE ON GAS FADING OF ACETATE DYES

THIS committee was appointed by the Research Committee of the A.A.T.C.C. on November 17, 1939. Its problem is to study the fading of dyed acetate rayon fabrics when exposed to the fumes of burnt gases in the atmosphere, and to recommend a uniform method and apparatus for laboratory use, by means of which gas fading similar to that occurring in actual practice may be produced under controlled conditions, the relative fastness to gas fading of the various acetate dyes may be definitely established, and the probable degree of resistance of any particular dyed acetate rayon fabric to gas fading may be determined in advance, in any laboratory using this standard method and apparatus.

It has been established by Goodall, and substantiated by Rowe and Chamberlain, that it is the oxides of nitrogen in the atmosphere which are the fundamental cause of the destructive color changes that occur during storage and use of dyed acetate rayon fabrics. Burning illuminating gas is a convenient source of oxides of nitrogen, and is used in most if not all of the testing laboratories in this country which are investigating gas fading. However, each laboratory has established its own procedure for applying the burnt gases to the dyed fabrics, and there is much variation in details such as the temperature of the fume chamber, the time of exposure, the quantity of gas consumed in a given time and the composition of the illuminating gas itself. These differences exist mainly because accurate information is lacking regarding the amount of change (on the average) that any given color or shade will undergo in actual use or storage during a definite period of time, as a result of gas fading; consequently it cannot be assumed that any laboratory test is the equivalent of a specific number of weeks, months or years of actual exposure to atmospheric conditions. It is therefore natural that some laboratories will, in the interests of prudence, lean towards severity in their test, while others will be less critical. It is our hope that ultimately a standard apparatus may be devised which will be adopted by all of the testing laboratories, thus enabling all to carry out the same test in the same manner and obtain the same result. It is our judgment that a standardized gas fading test is just as important as a standardized laundry or shrinkage test.

On account of the many uncontrollable variations in the atmospheric conditions to which a particular dyed fabric may be subjected while in storage or use, a shade may fade quickly, or slowly, or not at all in a given period of time. It is the intention of the committee to select a group of acetate dyes of various degrees of sensitiveness to gas fading (determined in advance) and send to different sections of the country fabrics colored with these dyes, to be exposed to the atmosphere for varying periods of time and under varying conditions; and subsequently to study

the information so obtained, in order to determine about how long an exposure is necessary (on the average) to make each of these dyes change its shade. However, it will require several months at least to secure any valuable data from this source. In the meantime it is planned to make at once a careful examination of the available dyes, in order to select a few which exhibit particular degrees of sensitivity; taking one of the SRA Blues as representing the most sensitive type, and three or four others showing 2, 4, 6 or 8 times the resistance of the Blue. If this can be done, it should be possible for all of the testing laboratories to use these dyes as standards without making any immediate change in their respective apparatus. In our opinion this would be a long step in the direction of a standardized test.

The committee is aware that in test methods used at present there may exist unknown influences which may cause the results to vary from one laboratory to the next, or even at different times in the same apparatus. However, it is reasonable to believe that such variations, if they do exist, will have only a slight influence on the interpretation of the results as regards their practical value.

The committee has obtained information from a large number of tests, conducted under carefully controlled conditions, indicating the influence of variations in temperature, the quantity of gas consumed, the relative humidity and quantity of air passing over the samples on the time required to effect definite degrees of change on colored fabrics. These tests have shown that variations in any or all of these factors influence principally the time required to secure any predetermined degree of color change. The more gas consumed between 1 and 10 cubic feet per hour, the more rapid is the rate of destructive action. The higher the temperature between 60° and 200° F., the more rapid the rate of color change. Variation in relative humidity between 10 and 70 per cent has only a negligible influence on the rate or degree of change. Within undetermined limits, increasing the rate of air flow around the burner and thus around or over the samples increases the rate or degree of color change. However, any or all of these variations do not influence the direction of color change. It remains invariably constant, toward red and/or weak, or toward green, then toward red and then weaker. These facts indicate that any and all apparatus at present in use, in which natural or manufactured gas is used to provide the oxides of nitrogen, is suitable for test purposes. They differ principally in the time required to effect a definite predetermined degree of change, but all will produce an identical degree and direction of color change if the test samples are exposed to them for the required time.

Many, if not all, of the test procedures at present in use are based on prescribed numbers of hours of exposure. Some of the apparatus have a rectangular shape, with no means provided to assist uniform distribution of the air within the apparatus. Reliance is placed on the natural tendency of heated air to rise. This is supplemented with a baffle to cause the air within the box to flow along the bottom along the baffle, then upward around the samples and pass out on the opposite side through an opening near the top. Theoretically the principle is sound; however, the time required for the test can be shortened by any means that will cause an increased flow of air through the box. This must be compensated by increasing the quantity of gas burned. Theoretically the results of tests in such an apparatus should not be consistently uniform unless the tested samples had about the same total surface area each time; yet some who use such apparatus state that the results obtained are uniform in degree of change, regardless of the number of samples tested together. With regard to the question whether variations in the composition of the illuminating gas will influence the results of the test, the committee does not have this information but will endeavor to obtain it.

We wish to acknowledge the cordial cooperation which we have received from all of the testing laboratories which have been so far approached, and the active assistance which B. A. Ryberg, Research Associate of the A.A.T.C.C., has rendered by obtaining information on this subject from various sources. We shall be glad to hear from anyone who has suggestions to offer for carrying out this undertaking. It should perhaps be pointed out, however, that we are not interested in any after-treatments for making acetate dyes faster to gas fading, as the testing of such treatments does not come within the scope of our instructions.

W. H. Cady
J. R. Bonnar
C. A. Seibert

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 37; married.

A-B-9

Education—Bradford Durfee Textile School, 1918, chemistry and dyeing course.

Experience—Dye application, textile and color chemist; good general factory, laboratory and office experience; accustomed to assuming responsibility; handled all types of help; purchased chemicals, dyes, etc.; executive ability; good personality.

Age 42; American, married; will go anywhere for interesting work; references.

A-B-10

Education—1 year of textile chemistry, day course, Philadelphia Textile School; also business course.

Experience—3 years as apprentice in weaving mill in Germany, office and stock room, general clerical work, practice in all departments of cotton manufacture, dyeing, bleaching and finishing of cotton-rayon mixtures, piece and package processing; several mos. in laboratory of German dyestuff manufacturer, dyestuffs and assistants and their application, vat and naphthol dyeing.

Age 20; will go anywhere in U. S.

A-B-11

Education: Graduate chemist. Correspond and converse German, some French.

Experience: 3 years dyer; 4 years dyestuff testing, trouble-shooting, purchasing; 4 years demonstrating, consulting, and supervising for large dyestuff manufacturer. Thoroughly experienced on rayon, cotton, silk, acetates, printing, vats. Fullest references as to character and ability. Seeks position as technician, consultant, or superintendent with reliable dyestuff sales organization or dyehouse. Age 33, married.

A-B-12

Education—Philadelphia Textile School (Evening), Chemistry and Dyeing, Quantitative and Qualitative Analysis.

Experience—Two years in yarn office, making wool stock blends. Last 6 years in dyehouse, 4 years as kettle hand, 2 years in piece dye work. Worked on yarn, raw stock and piece goods; has been dyer on union piece goods, cotton, rayon and wool, leaving wool white; also worked on all wool fabrics and woolen cross dyes; also considerable laboratory experience doing laboratory dyeings and extraction work. Seeks position as dyer or laboratory technician.

Age 30; married; references.

A-B-13

Education—B.S., Chemical Engineering, Oregon State College, 1926.

Experience—First experience in dry cleaning plant; few months as sampling and control chemist with potash and chemical company; two years in dry cleaning plant, all phases of work; few months on routine and special analyses, plant problems, special studies and research for gas and electric company; 10 years teaching experience on textile chemistry, dyeing and textile testing covering all general and special courses in this field; consultant work with various mills. Seeks position in textile chemistry or dyeing.

Age 37; married; will go anywhere; references.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-8

Education—B.T.C., 1933, Lowell Textile Institute.

Experience—5 months as rayon slasher tender; 8 months color matching, dye testing and analytical work; 5 years with large print works in rayon finishing department, laboratory, color matching, dye testing, assistant rayon dyer. Seeks position as rayon dyer, assistant dyer, or any job in a rayon dyeing and finishing plant. Age 29; single.

A-B-C-9

Education—Lowell Textile Institute; chemistry, dyeing and textile finishing.

Experience—Twelve years head dyer in hosiery mills. Dyeing all types of fibers and in combination. Knowledge of all dye applications. Matching and formula making. Charge of every department in a hosiery mill except fixing machinery. Has done jigg work on cottons and rayons. Desires position in hosiery, or in any field. Would like to work as an assistant to head dyer in a woolen or rayon mill. Age 42; married. Will go anywhere in the United States.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-F-1

Education—Textile Institute course in Dyeing and Chemistry; Extension work at Brown University; Executive Training with Alexander Hamilton Institute of New York, N. Y.; working knowledge of one foreign language.

Experience—Dyeing executive on all types of textiles including stock, yarns in the skein, warp and package, and piece goods. Thorough knowledge of all classes of dyes and dyestuffs and their successful practical application in the plant. Extensive knowledge of all types and makes of equipment for dyeing, bleaching, mercerizing and finishing. Laboratory practice in testing, standardizing, purchasing, costing, planning and checking processes, and market analysis. Good manager of personnel for better efficiency in retaining friendly labor relations. Conversant with modern methods for quality production economically secured through better coordination and correct alignment in processing, on cotton, viscose and acetate rayon, silk, wool, worsted, and mixtures. In excellent mental and physical health; excellent references.

A-B-D-1

Education—Special courses in general chemistry.

Experience—Twenty-nine years' experience in application and standardization laboratories of various dyestuff manufacturers. Well versed in the application of dyestuffs to different textile fibers, i.e., wool, cotton, rayon, silk, acetate rayon and unions, using direct, acid, diazo, sulfur, acetate rayon, chrome and after-treated direct dyestuffs. Six months' actual dye house experience on jigs, open boxes, padders, bleaching and mercerizing. Experience demonstrating sulfur and direct colors at various mills. Seeks position as textile colorist in application laboratory and demonstrator.

Age 46; single; references.

A-D-1

Education—Graduate of New Bedford Textile School, 1936.

Experience—Chemist for woolen mill 7 months; technician and salesman for chemical company 1 year and 9 months. Seeks position as salesman or in purchasing department.

Will go anywhere; married; references.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Graduate New Bedford Textile School; also post graduate work in advanced microscopy and rayon testing.

Experience—Five weeks in color shop of print works. Wants position in anything associated with textile chemistry, dyeing, finishing and testing.

Single; age 21; references.

B-C-3

Education—Graduate, Philadelphia Textile School; speaks German fluently.

Experience—Employed at velvet company for 7½ years. Past 2 years working in finishing department on regular, waterproof and crush-resistant finishes (resin finishes). Can take charge of finishing of velvets. Have some piece dyeing experience.

29 years of age; married; will go anywhere.

B-D-1

Education—General education in England. Chemistry and Dyeing Courses at Huddersfield Technical School.

Experience—Has been a superintendent of dyeing since 1911. Has had experience in worsted mills, hosiery mills and woolen mills. Congenial, sober and reliable. Married; references; age 53.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

Twentieth

ANNUAL MEETING AND CONVENTION

HOTEL COMMODORE

NEW YORK CITY

OCTOBER 18TH AND 19TH, 1940

General Chairman

PATRICK J. KENNEDY

—♦—

ENTERTAINMENT COMMITTEE

John Hubsmith

Arthur Nazzaro

—♦—

Auspices of

NEW YORK SECTION

Schuyler Studios, Inc.

S. M. CONN
Chairman, Entertainment Committee

S. M. Conn, Manager, Organic Chemicals Department, E. I. duPont de Nemours & Co., Inc., 40 Worth Street, New York City, will be chairman of the entertainment committee for the twentieth annual meeting. In addition to an extensive acquaintance in the textile and chemical fields, Mr. Conn further has a host of friends in the theatrical profession. The members are thus assured a novel and distinctive program of entertainment. The names of Mr. Conn's able assistants appear at the left.

Combination of

Wool Protein with Acid and Base

(Continued from page 134)

Deviations from this regularity appear only where the maximum and zero values are approached, but at both these extremes the quantity plotted is extremely sensitive to experimental error. In addition, the data may well deviate from this simple theoretical relation for acid-combination as zero acid-combination is approached, since the base combination function which begins to be of importance in this region has been left out of account. As a result of this additional factor, the curves must intersect at the base line within a narrow interval of pH, and cannot remain parallel.

The slope of the theoretical curve in Figure 8 for constant ionic strength is —1.0. The slopes of the lines through the experimental points for ionic strengths up to 0.2 are exactly —0.50. Thus, a very simple relation exists between the experimental data and the theoretical curves which were derived on the assumption of a single dissociation constant for all the dissociating groups. The simplicity of this relation appears to support the view that the curve is the sum of a *continuous* series of curves for the individual dissociating groups, which differ in strength from one another by slight increments determined by some law of electrical interaction between their charges, rather than that the curve is the sum of a few groups of identical curves with widely different constants.

The slope of the theoretical curve for no added salt (eq. 7′) depends on the ratio of K_H' to K_A'. When $K_A' \gg K_H'$ (the more probable case with HCl) the slope approaches —2. When K_A' is only ten times larger than K_H' the slope is still nearly —2 for small amounts of acid bound but its absolute value becomes considerably smaller for larger amounts. However, the data obtained in the absence of salt, shown in Figure 8, have a slope of very nearly —1 when the amounts of acid bound are less than three-quarters of the maximum. For larger amounts bound, the slope approaches —2. It is not surprising that the discrepancy between the simple theory and the measurements should be more serious and less regular in the absence of salt than at constant ionic strength, since the dependence of acid bound on hydrogen ion concentration is eq. 7′ or 7″ is essentially of higher degree than is eq. 7. The transition (involving a summation) from the simple equation for a monovalent acid to the proper polyvalent equation, is therefore more complicated.

The fact that over a great part of the pH range the slope obtained in the absence of salt is also just one-half of the value required by the equations has the fortuitous result that the experimental curve somewhat resembles the curve of the simple law of mass action for a monobasic acid[44]. This approximate resemblance must be regarded as the resultant of the opposing effects of the steepening of the curve caused by simultaneous variation of hydrogen and chloride ions, and the broadening effect of electrostatic interaction between many identical dissociating groups.

The hypothesis that the departure of the individual experimental curves from the slopes predicted by eq. 7 and 7′ is caused solely by the high polyvalency of the wool protein, does not depend exclusively on the considerations just discussed. It is very strongly supported

Figure 8. The experimental data for acid combination as a function of pH and chloride concentration (corrected by subtraction of the estimated contribution of histidine) compared with the linear relations described by equations 7 and 7′. The straight lines through the experimental points over the range of approximately 5 per cent to 90 per cent of maximal combination were drawn with a slope of 0.5. The broken lines represent the theoretical equations for no-salt (7′) and for infinite salt (7) respectively.

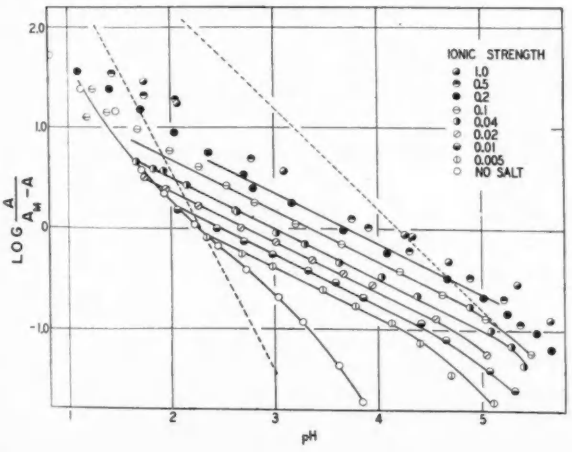
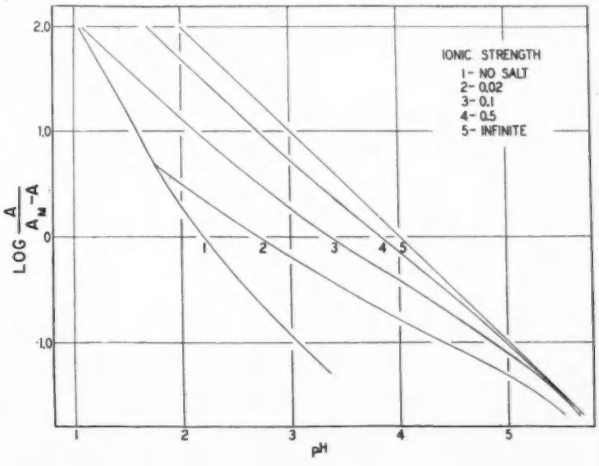


Figure 9. The effect of different constant anion concentrations on the acid bound by a non-diffusible acid as a function of pH. The parameters employed in the application of the Donnan equations are given in the text.



by the almost exact correspondence of the experimental curves for wool at high constant ionic strengths with the corresponding curves for egg albumen. When similarly plotted as log $\frac{A}{A_m - A}$ against pH these data (at least for dilute salt solutions) also yield straight lines, with slopes which are also very nearly —0.5. The same linear relationship between log $\frac{A}{A_m - A}$ and pH has appeared in investigations of widely different dissolved substances which have in common only the properties of polybasicity and high-molecular weight. These substances include, among others, polyacrylic acid[32], and certain nucleic acids[23, 41]. Kern has shown that, over a wide range of polymerization numbers, the slope of the linear relationship for polyacrylic acid is also almost exactly —0.50.

2. Alternative Analysis by the Donnan Equilibrium

The difficulties inherent in application of the Donnan equations to the combination of wool fibers with acid have already been detailed. However, if a somewhat arbitrary selection of parameters is permitted, an alternative treatment for the restrictions on combination of acid due to the presence of two phases is possible, and a number of features of the present data can be described as direct consequences of the Donnan equations. In application of the Donnan equilibrium to fibers, a choice must be made between regarding the solid phase as a dispersed phase (in imbibed solvent), permeable to dissolved acid and salts, and the alternative view that it is a true solid phase in which the phenomena of acid combination take place in an external adsorption layer. The first of these models has been chosen as a basis for calculation, since the second offers no obvious basis for the assignment of any but arbitrary numerical parameters.

The result of this choice is given in Figure 9, which shows calculated curves of acid combined by protein as log $\frac{A}{A_m - A}$. In this calculation a single dissociation constant, 1×10^{-4}, and a protein concentration of 0.8 equivalent per liter have been used. The latter value bears a reasonable relation to the equivalent weight of wool, which is approximately 1250, and its moisture content at saturation of approximately 30 per cent by weight. Although the relations of the curves calculated for no added salt and for different constant ionic strengths would be appreciably altered by the choice of other numerical values, their positions on the pH axis and the value of the maximum fix the relation of the dissociation constant to the equivalent concentration within fairly narrow limits. Activity coefficients have been neglected. The ordinates of the curves represent only the acid reacting with the protein and do not include the acid which may be merely dissolved in the fiber phase. The latter should be practically negligible except in the immediate vicinity of the top of the curve.

It is immediately evident that the curves in Figure 9 satisfy the requirements imposed by the data in three outstanding respects: (1) The curve for the case of no added salt is very similar to the experimental one; (2) the curves for constant ionic strengths are less steep than the curve for no salt, and their average slopes, although still to high, are nearer the experimental ones than the slopes given by eq. 7, which were twice as large as those required by the data; (3) when measured in the upper half of the figure, the dependence on ionic strength of the pH values at which a given amount of acid is combined is approximately logarithmic when the ionic strengths are low; when the ionic strengths are high, the positions of the curves with respect to the pH axis approach a limit.

In another important respect, however, the curves of Figure 9 are entirely different from those obtained by experiment or calculated from eq. 7 (shown in Figure 8); the experimental curves are roughly parallel except at very high ionic strengths and as they approach closely to the base line. The curves of Figure 9, on the contrary, converge continuously, and this convergence is inherent in any simple analysis by means of the Donnan equilibrium.

Another consideration must be taken into account, before accepting as significant the partial agreement of the Donnan equations with experiment. It has already been shown that there is a detailed agreement between the experimental data for wool and for dissolved egg albumen at moderate ionic strengths. If significance were to be attached to the fact that the Donnan equations reduced the slope of the theoretical monobasic acid curve to a value considerably closer to its experimental value for wool, then it would seem necessary to conclude that the Donnan treatment must be applied also to egg albumen *in solution*. The further requirement that the application of the Donnan equations to the *dissolved molecules* must involve nearly identical numerical values for the parameters of the equations in the two physically quite distinct cases is even less acceptable.

The model which has been used as a basis for the application of the Donnan equations to the present experiments is intrinsically unreal. It is unlikely, for example, that all the water contained in the immersed fibers can be regarded as solvent water. Not only is it comparable in magnitude with the water of crystallization of protein in general, but it corresponds closely with the hypothesis of definite and limited hydration of the polar groups or bonds of the wool molecule*. Such bound water can be regarded as a solvent medium only in a very restricted sense and it is hardly likely that acids or salts will distribute themselves between it and the external solvent medium in a simple one-to-one ratio. It has not proved possible to detect experimentally any combination with neutral salts when fibers containing half of the maximum amount of water which they can absorb are placed in 0.2 *M* KCl at pH 6.4. Thus, half or nearly half the maximum water content is not free to dissolve ionized acids or salts. This conclusion also results from a recent detailed study of

*Unlike such cases as swollen gelatin to which the Donnan equations are more legitimately applied.

moisture absorption of cotton fibers in this laboratory[42].

The principal distinction for practical purposes (such as the interpretation of acid dyeing) between the mechanism of acid combination proposed in this paper the alternative treatment in terms of the Donnan equilibrium, lies in the expectation that the specific affinities $\left(\frac{1}{K_A'}\right)$ of different anions for wool may vary considerably. Conversely the experimental study of such a variation and its dependence on such variables as temperature and dielectric constant has considerable bearing on the views discussed here, and is at present in progress.

The authors are indebted to Charles H. Fugitt for many of the experimental measurements reported in this paper.

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TRADE NOTES • NEW PRODUCTS

OBITUARY

CHARLES ARTHUR WHITE

CHARLES A. WHITE, secretary-treasurer of the Leeds & Northrup Co., died on March 2nd at Germantown Hospital in Philadelphia, Pa., after a two weeks' illness. He was fifty-eight years old. He joined Leeds & Northrup in 1920 as chief accountant and was made secretary-treasurer in 1928. He was a past president of the Rotary Club of Philadelphia and for many years was active in the work of the Presbyterian Church and the Y.M.C.A. He is survived by his wife and one son.

• A.S.T.M. MEETINGS

The 1940 spring meeting of the American Society for Testing Materials was held on March 6th at the Hotel Statler, Detroit, Michigan. A.S.T.M. Committee Week was held at the same place March 4th to 8th, inclusive. The forty-third annual meeting will be held June 24th-28th at Chalfonte-Haddon Hall, Atlantic City, N. J.

• CIBA REVIEW

Ciba Review for February, 1940, features the subject of "The Essentials of Handicrafts and the Craft of Weaving among Primitive Peoples." Contents are described by the following titles: Primitive and Civilized Peoples; The Development of Handicrafts among Primitive Peoples; The Tools of Primitive Peoples; The Development of Weaving among Primitive Peoples; Ethnological Notes. There are many unusually interesting illu

• S.O.C.M.A. M

The regular monthly meeting of the Synthetic Organic Chemical Manufacturers Association was held at the Chemists' Club, New York City, on Thursday, February 15th. Francis P. Garvan, Jr., who has succeeded his late father as president of the Chemical Foundation, Inc., was present and introduced to the meeting.

• KALI BOOKLET

Kali Mfg. Co., 1410 North Front St., Philadelphia, Pa., has recently published a booklet entitled "Matching the Sample" which represents the results of one year's research work to determine the difference of shade due to amount of moisture left in the fibers. The authors were Eugene W. Wall, Chief Chemist, Kali Manufacturing Co. and Henry E. Millson, Textile Chemist. The authors state that the purpose of the investigation was to correlate the results of hundreds of tests and observations of the effects of improper drying and airing; to offset some rather gen-

erally held erroneous ideas about "oxidation" of certain colors, to consider the natural moisture content of the various fibers and its effect upon the ultimate match, and to point out some interesting and unusual behaviors of certain dyestuffs. Copies are available upon request.

• CALCO BULLETIN

Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., has released its technical bulletin No. 546 which is entitled "Machinery Used in the Application of Dyes to Cellulosic Fibers." It was written by Ormond W. Clark of Calco's technical service department and was presented as a paper at the annual meeting of the Textile Division of the American Society of Mechanical Engineers on December 9, 1939. The paper discusses, from the viewpoint of the textile chemist and dyer, the following factors: (1) the inherent nature of the fast dyes and the chemistry of their application as it affects machine design; (2) the essentials of a satisfactory dyeing process; (3) the dyeing processes at different stages of manufacture; (4) the evolution of dyehouse machinery, most of which has occurred in the last 15 years, and some possibilities of further improvement. Copies of the bulletin are available upon request to the Calco company.

• CENSUS

This April, 120,000 Census enumerators will visit 32 million families, to enumerate the Nation's estimated 132,000,000 population, and to ask a series of questions designed to give the facts which will provide illuminating data on problems which have become particularly pressing in the last decade. It is stated that vital new statistical knowledge will be developed on education, mass migration, employment, unemployment, occupation and wage and salary income, and by means of modern computing devices, preliminary summaries of the basic facts will be made available at an early date.

Processing the mass of "raw" figures to be collected will involve the services of more than 7,000 clerks and a huge battery of mechanical tabulators at the Washington headquarters of the Bureau of the Census. It is said that every effort will be made to get the end-product—the tabulated results of the national inventory—to the public at the earliest possible moment.

A count of the population and its distribution remains the basic purpose of the inquiry, but in line with the axiom, "New times, new problems," the schedule of questions covers a broader field than could have been foreseen in 1790. There are separate columns for recording the answers to each of 33 questions on the general population schedule. Of these questions the average person is not likely to have to answer more than half. In addition, there are 16 columns of questions for a 5 per cent sample of the population.

• DYEING "MOUNTIES" UNIFORMS

The Rodney Hunt Machine Company of Orange, Mass., state that one of their new stainless steel "Tru-Shade" Dyeing Machines is being used to dye the brilliant scarlet cloth that is used in making uniforms for Canadian "mounties." The machine was a recent installation for the Paton Manufacturing Company in Sherbrooke, Quebec. Other recent Canadian installations of Rodney Hunt Machines have been for Ayers, Ltd., William Collie Woolen Manufacturers, Bates and Innes, and Caldwell Linen.

• SANDOZ OPENS CHICAGO OFFICE

Sandoz Chemical Works, Inc., announces the opening of a Chicago office located at 231 South La Salle Street, Telephone: State 2928.

In charge of the new sales office are Arthur A. Barker, resident manager, assisted by Frank G. Roux, both of whom have been associated with the company headquarters in New York.

It is stated that the Chicago office personnel is to be augmented from time to time, in a technical advisory capacity, by R. Lindenmaier, specializing in textile chemical auxiliaries, Arthur Spalding and Henry Hennig, technicians respectively, in the woolen and hosiery trades.

The Mid-Western leather trade will also have the attention of an experienced representative.

• DU PONT BOOKLET

A new booklet, "Emulsifying with the Fatty Alcohol Sulfates," has just been issued by the Fine Chemicals Division of E. I. du Pont de Nemours & Company. It contains a discussion of emulsions and the characteristics of "Duponol" alcohol sulfate emulsifying agents.

Sections of the booklet are devoted to solvent emulsions, oil emulsions, wax emulsions and special emulsions and sprays. Formulae for the preparation of the following emulsions are included: tetralin, pine oil, benzine, toluene, kerosene, soluble oils, linseed oil, palm oil, wool oil, softening emulsions, self-emulsifying laundry wax, self-emulsifying paraffin wax, Carnauba wax, dry bright floor polishes, leather polishes, shoemakers' wax burnishing polishes, resin emulsions, neat's foot oil emulsions, medicated oil emulsions, mosquito control sprays, road spray emulsions and asphalt emulsions.

• SMITH, DRUM & CO., "MODERN PIONEER"

At the Philadelphia Modern Pioneers Banquet, commemorating the 150th Anniversary of the United States Patent System, Smith, Drum & Co., among others, was presented with an award for "distinguished achievement in the field of science and invention."

The Philadelphia Banquet, honoring Modern Pioneers on the Frontiers of Industry in Eastern Pennsylvania, Delaware and Southern New Jersey, was held at the Bellevue-Stratford Hotel on February 16.

It is stated that the award to Smith, Drum & Co. was the first and only one presented to a manufacturer of textile dyeing machinery in the Eastern Pennsylvania, Delaware and Southern New Jersey area.

This was the largest of all those held in the various sections throughout the United States, being attended by nearly 1000 persons; and was sponsored by the Philadelphia Chamber of Commerce and the National Association of Manufacturers.

• WEAVE-LOK

The Warwick Chemical Company of West Warwick, R. I. announces the addition of Weave-Lok, an improved slip proofing agent, to its line of chemical specialties. It is a new resin finish primarily recommended by the manufacturers for underwear fabrics, linings, and dress fabrics. Weave-Lok is a self-contained product—merely requiring the use of a 2 to 4 per cent solution without the addition of any other materials although finishing oils may be used in combination with it. It is claimed that, unlike previous agents of its type, Weave-Lok imparts a soft hand without any trace of harshness or brittleness. It is said to stop pulling at the seams, prevent slipping, sagging or fraying. Weave-Lok is a permanent finish, said to be unaffected even by dry cleanings. Detailed technical bulletins on Weave-Lok are available by writing to the Warwick Chemical Co., West Warwick, R. I.

• PARAFFINE WAX EMULSIFIER

Development of a paraffine wax emulsifier for use in all processes and products where wax is needed has been announced by the Technical Service Department of National Oil Products Co., Harrison, N. J. This new emulsifier, named NOPCO 2251, is a heavy, tan colored paste that is mixed with paraffine wax to make the wax water dispersible or emulsifiable, chemists state. In a laboratory report, the Technical Service Department reported:

"The new emulsifier is a chemically compounded material which, upon rendering the wax water soluble, is capable of producing a stabilized emulsion spontaneously

and without the application of energy in the form of rapid agitation or shearing effect, for example as obtained in a colloid mill. No special equipment is necessary."

• N. C. NEW TEXTILE BUILDING

Two modern new buildings devoted to the enrichment of human life through agricultural and industrial progress in North Carolina were dedicated at State College March 5. The chemistry building and textile building were presented for the use of the entire State in stirring dedicatory addresses delivered, respectively, by Dr. Ralph W. Bost, head of the chemistry department in the University of North Carolina unit at Chapel Hill, and Heriot Clarkson, senior associate justice of the North Carolina Supreme Court. It was an historic anniversary for State College. Just 53 years ago the General Assembly, led to realize North Carolina's need for higher education in agriculture and the technical subjects, ratified the act to create State College.

Exercises in the textile building, which has not been named, brought a reunion of three men vitally allied with the birth and growth of textile education in North Carolina. They were Governor Hoey, Judge Clarkson and Dean Thomas Nelson, who has headed the textile school since it was created in 1901.

Judge Clarkson, as a member of the General Assembly, presented in 1899 a bill to establish a textile school at State College. It passed the House and met defeat in the Senate. Two years later the bill became law. In both sessions Judge Clarkson was aided in the battle by a young legislator from Cleveland County who was barely old enough to vote. He was Clyde R. Hoey.

Governor Hoey congratulated Dean Nelson and said he knew of no school contributing more to the material progress of North Carolina than State College.

The two new buildings, considered among the most modern in the nation, were constructed with the help of the Public Works Administration and formed a major part of State College's $1,700,000 expansion program last year.

Both structures were formally presented to the Greater University by Gus Palmer, resident engineer for PWA, and accepted by G. Maurice Hill, assistant business manager of the University, who acted in the absence of President Frank P. Graham, now recuperating in Florida from a recent illness.

Col. J. W. Harrelson, dean of administration, presided over both programs, which were well-attended by friends of the college and members of the college community.

• NATIONAL STARCH PROMOTIONS

Four major executive promotions, the most comprehensive in the entire history of National Starch Products, Inc., were announced by that company at its national sales convention at the Hotel Delmonico, New York, February 23-24.

Chester A. Gage, vice-president and for the last 15 years manager of its mid-western division at Chicago, has been named vice-president in charge of sales, and has joined the company's New York executive staff. Milton J. Heim, manager of National's central division at Philadelphia, has succeeded Mr. Gage at Chicago. Donald D. Pascal, who for five years has been head of the company's service department at New York, has succeeded Mr. Heim at Philadelphia. Philip M. Liner, who for many years has covered the southern New England states in a supervisory and sales capacity, has been appointed manager of National's New England division at Boston.

National's two-day sales convention was attended by 125 men, including executives, salesmen, and technical service men from its various United States and Canadian offices.

The first day was devoted entirely to talks on the manufacture and processing of starch, and its uses in foods, textiles, paper, and confectionery. Motion pictures of the company's starch plant at Indianapolis were shown to illustrate the stages in the manufacture of corn starch, from the time the corn is unloaded from the car until it emerges in bags or small retail packages. Other motion pictures, showing the company's plants and offices at Chicago, San Francisco, Boston, Toronto, London, and Veendam, Holland, were also exhibited.

The manufacture and application of glues, gums, and pastes formed the subjects of the second day's discussions. The meeting was concluded with a cocktail party and formal banquet in the grand ballroom of the Delmonico.

• LEIPZIG FAIR

It is stated that the Leipzig Spring Fair recently concluded compared favorably in size and attendance with peacetime fairs. It comprised 6,600 exhibits assembled from eighteen foreign countries, of which fifteen had prepared national collective exhibits. From the opening to the closing day buyers from 35 countries crowded the 24 exhibition buildings and the adjacent streets. Among the foreign countries participating in the show were Belgium, Bulgaria, Estonia, Greece, Italy, Japan, Yugoslavia, Latvia, Luxemburg, the Netherlands, Roumania, Sweden, Switzerland, Slovakia and Hungary. Eighty special trains carrying passengers at half the regular fare made it possible for business men to commute from Berlin and other German points, as well as from neutral countries. Exhibits included every conceivable art and industrial product, excepting the Technical Division which was omitted. Considering this change the volume of business transacted approached the level of preceding sessions of the Fair.

• RE-ELECTED PRESIDENT

Charles P. Gulick, one of the founders of the National Oil Products Company, Harrison, New Jersey, today was reelected president of the company after a two year absence from that post. Mr. Gulick, who left the presidency in June, 1938 to become Chairman of the Board, will also serve as Board Chairman. Mr. Gulick succeeds John H. Barton who retired as president on March 1st. Officers reelected were: Perc S. Brown, vice-president; G. D. Davis, vice-president; Thomas A. Printon, vice-president; Ralph A. Wechsler, treasurer; A. A. Vetter, secretary. These men were also re-elected directors of the company. Other directors reelected are Richard N. Gulick and William A. Coolidge.

The directors were elected by the stockholders who met today at the Harrison plant. Stockholders also voted to reduce the Board of Directors from nine to eight as the result of Mr. Barton's resignation.

In addition, the stockholders approved an increase in the capital stock structure from 200,000 shares of $4.00 par common to 300,000 shares. Mr. Gulick stated the additional stock will not be issued at this time but 'it is the desire of the management to provide increased capitalization to enable the company to act promptly should more funds be needed for corporate purposes."

Charles P. Gulick, one of the original incorporators of the National Oil Products Co. in 1907, held the office of treasurer of that firm up to 1932 when he was elected president.

Mr. Gulick is also president and director of the following subsidiaries: Metasap Chemical Company, Admiracion Laboratories, Nopco Chemical Co., Vitex Laboratories, Vitab Corporation, and Frozen Sunshine.

In addition to the foregoing, he is president of the Republic Yeast Corp., and the New Jersey Social Hygiene Association of Newark. Some of Mr. Gulick's other affiliations follow: He is vice-president of the Newark Athletic Club; a member of the East Orange Board of Education; has been appointed to serve on several important committees of the National Association of Manufacturers and serves on the following boards in addition to these mentioned above: that of the Harrison National Bank; Newark Rotary Club; Newark YMCA; Chemical Alliance; and Brown-Jeklin & Company.

• OPEN FORUM •

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

New Question

50—Recently, yellow spots, similar to "link marks," have been appearing on our chlorine bleached cotton yarn. This yarn is boiled twelve hours in a pressure kier and then bleached in cement vats. The spots are quite heavy and appear only when the yarn is wet. After drying, the spots disappear completely and there is no recurrence of them if the yarn is wet out again. The spots strip easily but an ordinary wash has no effect on them.

Any information readers can give concerning the cause of these spots will be greatly appreciated.—**H. G. S.**

Answer

48—One of our correspondents presented the following problem. We hope that some of our readers will be able to give the necessary information.

"Our black shades and some of the very dark blue, after dyeing are given a treatment we call 'painting,' which consists of running the cloth over a knurled roller, the roller turning in a bath of the pigment solution with the surplus being scraped off with a doctor blade. The solution consists of ground Prussian Blue with turpentine and linseed oil, the proportions being on the average about six pounds of Prussian Blue, ten pounds of turpentine and 100 pounds of linseed oil.

"The amount picked from the roller by the cloth is then thoroughly brushed into the cloth, after which the cloth has to be cured or 'stoved.' This consists of hanging the cloth in festoons in large chambers which are then closed and heated to approximately 250° F. The cloth must stay in these chambers a minimum of twelve hours, and in some cases where the 'painting' solution is somewhat heavier than average, twenty-four hours is required for proper drying and oxidation.

"We know that there are mechanical dryers on the market which will give better heat and considerably better circulation than we now have in our stoves thereby shortening the curing time considerably, but we believe the better solution is from some chemical means of quicker drying through oxidizing materials."—**L. B. B.**

Answer No. 2—In applying pigment colors from a turpentine and linseed oil bath, the only factors that can be adapted to give you a bath and quicker dyeing operation would be your turpentine and oil.

In our opinion, your ratio of turpentine to oil should be nearer one part to *six*, rather than the 1:10 ratio that you have been using. This will slightly improve your dyeing problem.

The only ideal way of solving this unique problem would be to either purchase or manufacture your own "boiled" linseed oil which can be made to fit your specifications. Raw linseed oil is, normally, the glyceryl ester of linoleic acid which has a very highly unsaturated molecule. A suggested method of boiling linseed oil consists of heating it to 400° to 500° F. for five or six hours in the presence of catalytic agents such as litharge or borate of manganese. Compounds are formed which facilitate the addition of oxygen to the unsaturated esters of the oil. An oil so treated becomes a much more rapidly drying oil and more stable when applied due to the lack of unsaturated compound in its makeup. It should cut your drying time in half and give you a more level finished product. —**B.B.**

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

Use Reporter Classified Advertisements for Results

SITUATION WANTED: *Color-Mixer for screen printing.* Thoroughly familiar with Rapidogens, Indigosols, vats, and acetate colors. Can take charge of production. Prefer New York state. Write Box No. 234, American Dyestuff Reporter, 440 Fourth Ave., New York, N.Y.

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